

CONSTRUCTION NOTES:

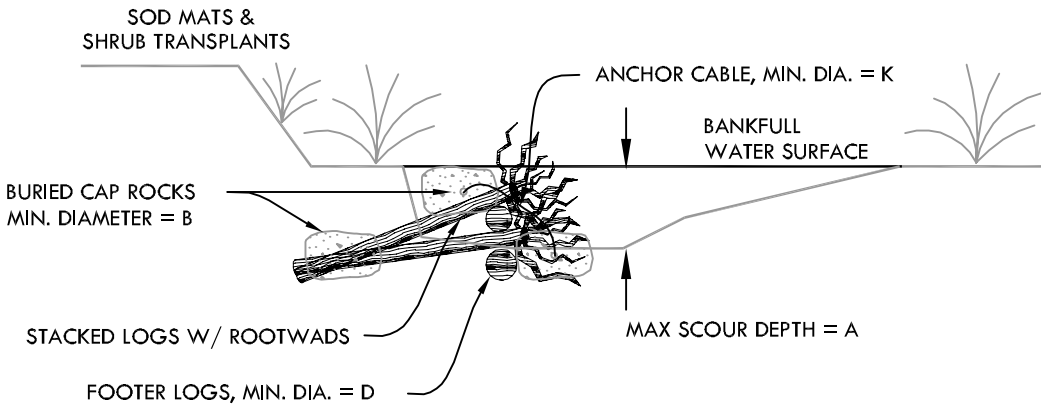
- 1. Excavate trench and set footer logs at maximum scour depth. Use footer logs with minimum diameter and stem length as specified.
- 2. Set rootwad logs on footer logs. Place logs stems sloping downward into bank from edge of water. Use rootwad logs with minimum fan diameter and stem length as specified.
- 3. Place additional logs and woody debris into trench to act as deflector logs and habitat cover. Number and size of habitat logs may vary from structures shown.
- 4. Ballast structure with cable and cap rocks of minimum diameter as specified. Set cap rocks below bankfull elevation on overlapping logs. The Construction Manager shall inspect and approve all structures prior to backfilling.
- 5. Backfill voids with native gravel and cobble to minimize gaps and piping of water. Cover with sod mats and shrub transplants at bankfull elevation.
- 6. Space structures as specified.
- 7. Notify Construction Manager of any proposed changes prior to implementation. The Construction Manager reserves the right to modify structure design specifications during construction if warranted due to unforeseen conditions.



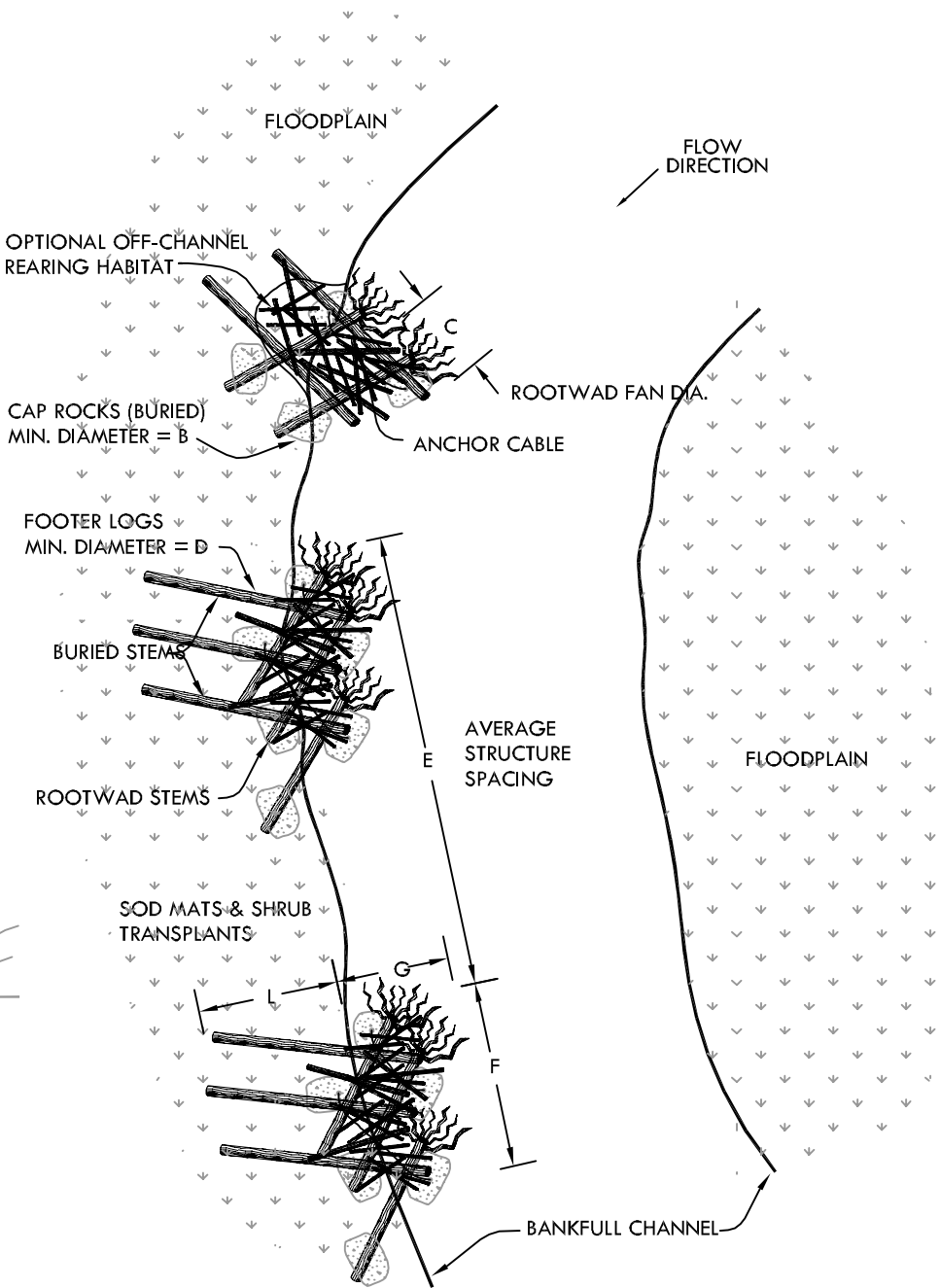
CONSTRUCTED LOG JAM STRUCTURES




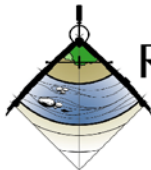
STRUCTURE DIMENSIONS	
A, MAX. SCOUR DEPTH	
B, MIN. CAP ROCK DIA.	36 in
C, MIN. ROOT FAN DIA.	6 ft
D, MIN. FOOTER LOG DIA.	18 in
E, AVG. STRUCTURE SPACING	
F, AVG. STRUCTURE LENGTH	50 ft
G, AVG. STRUCTURE WIDTH	15 ft
H, ROOTWAD STEM LENGTH	30 ft
J, FOOTER LOG STEM LENGTH	30 ft
K, MIN. ANCHOR CABLE DIA.	3/8 in
L, BANK KEY-IN DISTANCE	15 ft



ROOTWAD COMPOSITE
CROSS-SECTION



ROOTWAD COMPOSITES
PLAN VIEW

	FOR CFR 3 ONLY				ENGINEERED LOG STRUCTURES			WestWater Consultants, Inc. 1112 Catherine Lane Corvallis, MT 59828 tel: (406) 961-3348	 WestWater Consultants, Inc.	
					RESTORATION PLAN					
					DRAWN BY:	NMW	SHEET L-1	NOT TO SCALE	River Design Group, Inc. P.O. Box 1722 Whitefish, MT 59937 tel: (406) 862-4927 fax: (406) 862-4963 www.riverdesigngroup.net	 RIVER DESIGN GROUP, INC.
	2	10-14-05	KLC	FINAL	DESIGNED BY:	GTD/MSD				
	1	04-13-05	MSD	DRAFT	CHECKED BY:	MSD	FILE NAME: L-1 ELJ.dwg			
	NO.	DATE	BY	REVISION DESCRIPTION	PROJECT NO.:	RDG-04-018				

CONSTRUCTION NOTES:

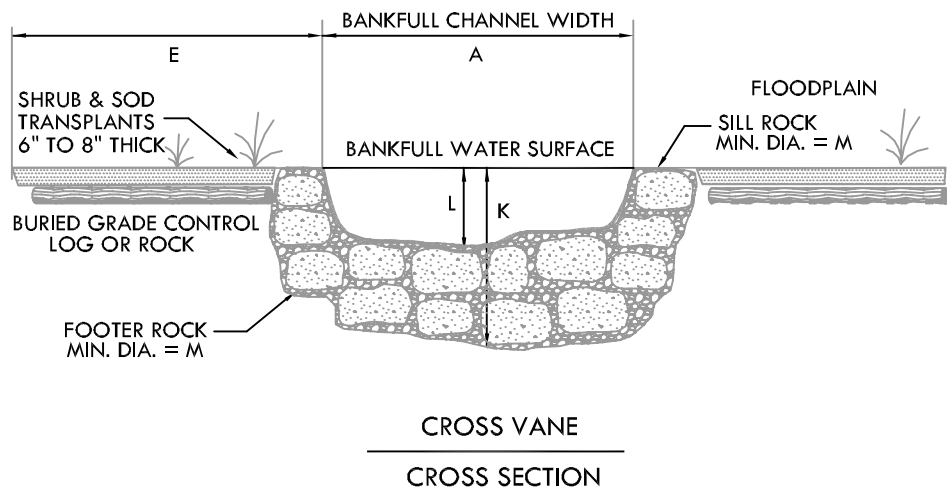
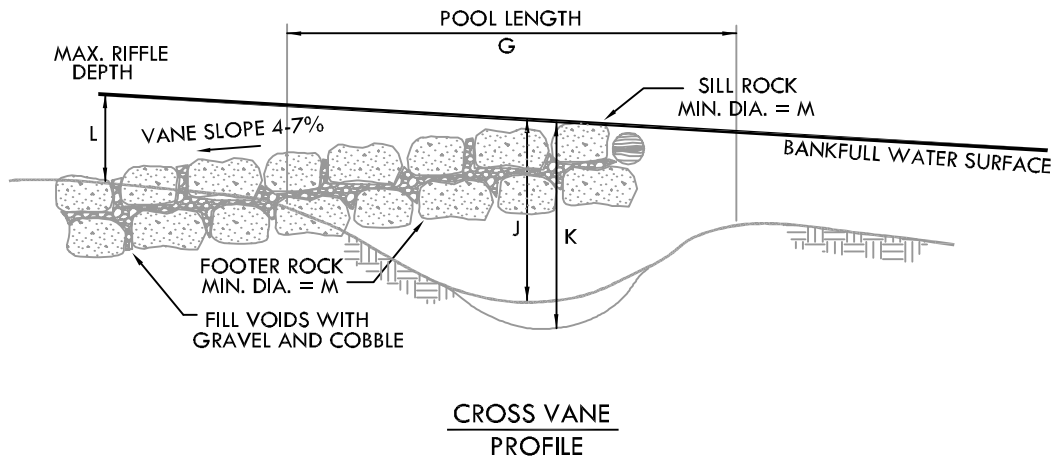
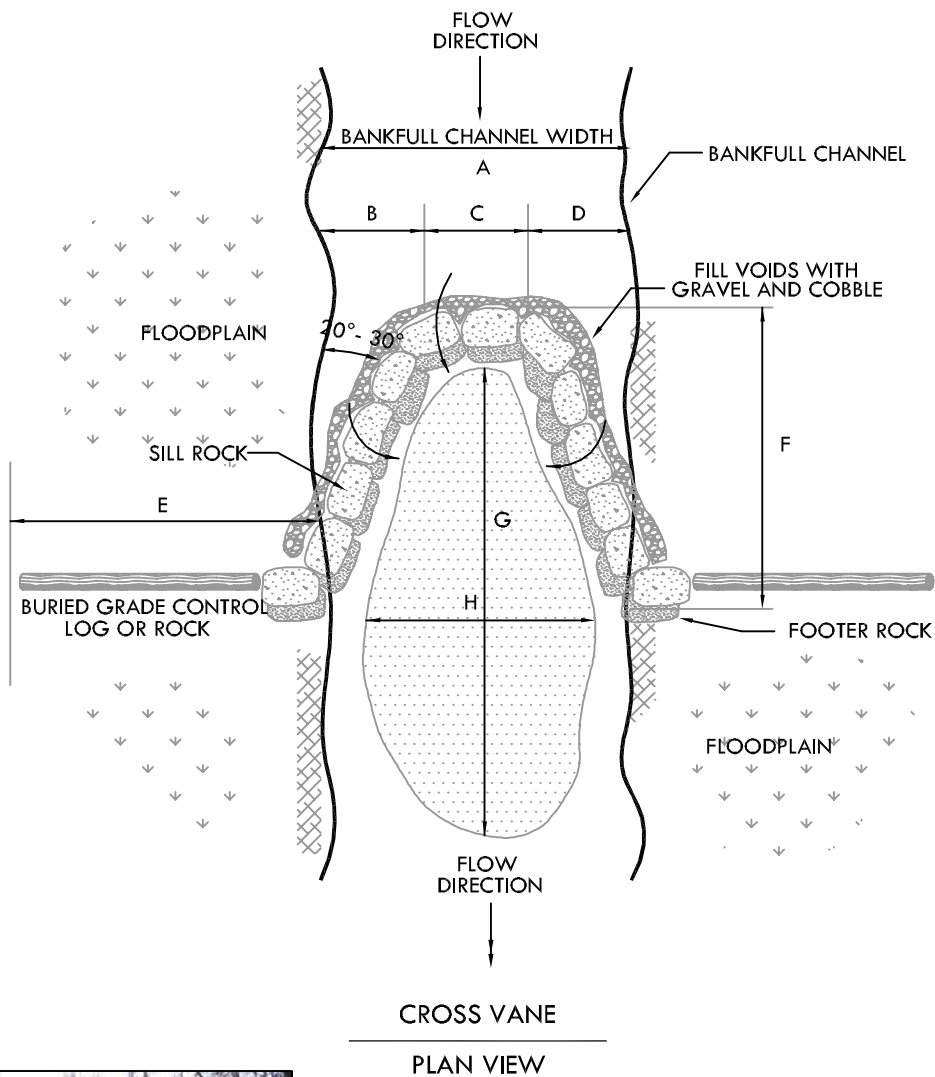
1. Construction shall begin at structure throat (upstream center) and proceed downstream toward banks. Use footer and sill rocks with minimum size as specified. Vane arm slope shall be between 4% and 7% as specified by the Construction Manager.
2. Excavate trench and stockpile excavated material for use as backfill. Place base of footer rocks at or below maximum scour depth. Minimize gaps between footer rocks. The Construction Manager shall inspect all footers prior to backfilling. Backfill sides of footer rocks with native gravel and cobble. Backfill shall be obtained from stockpiled material or excavated from downstream pool.
3. Place sill rocks on top of footer rocks. Sill rocks should be placed slightly upstream of footer rocks. Minimize gaps between sill rocks. The Construction Manager shall inspect the placement and elevation of sill rocks. The top of sill rocks shall not exceed the bankfull elevation.
4. Backfill voids around structure with native gravel and cobble to fill gaps and reduce piping of water. Backfill shall be obtained from stockpiled material or excavated from downstream pool.
5. Floodplain grade control sills shall be constructed of log or rock and shall be keyed into the floodplain no less than 50% of the maximum riffle depth. Top of floodplain grade control sills shall be 0.5 feet below bankfull elevation and covered with 0.5 feet of sod/shrub transplants.
6. Excavate pool according to specified dimensions. Use excavated material to backfill structure or haul to a location approved by the Construction Manager.
7. Notify the Construction Manager of any proposed changes prior to implementation. The Construction Manager reserves the right to modify structure design specifications during construction, if warranted, due to unforeseen conditions.

STRUCTURE DIMENSIONS

A = BANKFULL WIDTH	
B = RIGHT ARM WIDTH	0.33 A
C = THROAT WIDTH	0.33 A
D = LEFT ARM WIDTH	0.33 A
E = FLOODPLAIN GRADE CONTROL WIDTH	
F = LINEAR CROSS VANE LENGTH	A
G = POOL LENGTH	1.5 A
H = POOL WIDTH	
J = MAXIMUM POOL DEPTH	
K = MAXIMUM POOL SCOUR DEPTH	
L = MAXIMUM RIFFLE DEPTH	
M = MINIMUM ROCK DIAMETER	6.0 ft



EXAMPLE OF A CONSTRUCTED CROSS-VANE



ROCK CROSS VANE

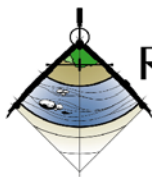
RESTORATION PLAN

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RIVER
DESIGN
GROUP, INC.

DRAWN BY:

NMW

DESIGNED BY:

GTD/MSD

CHECKED BY:

MSD

PROJECT NO.:

RDG-04-018

SHEET
L-2

FILE NAME:

L-2 Rock Cross Vane

NOT
TO
SCALE

2

10-15-05

KLC

FINAL

1

04-13-05

NMW

DRAFT

NO.

DATE

BY

REVISION DESCRIPTION

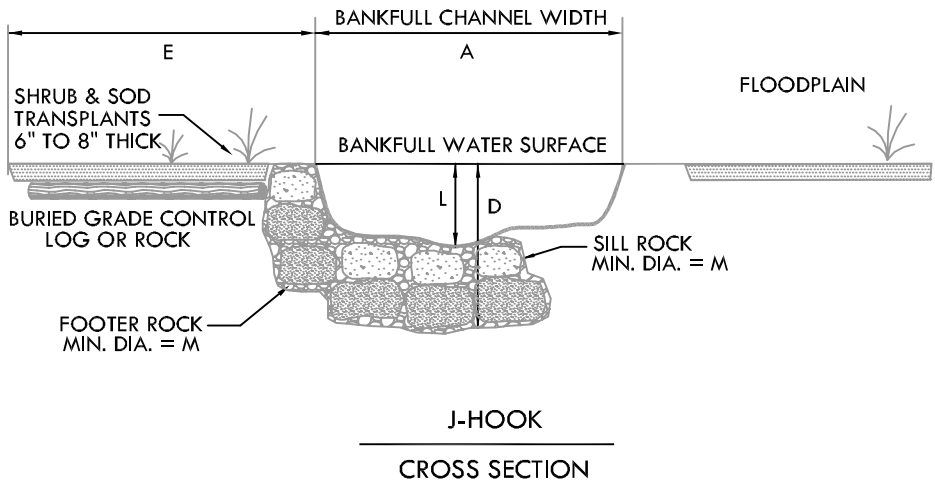
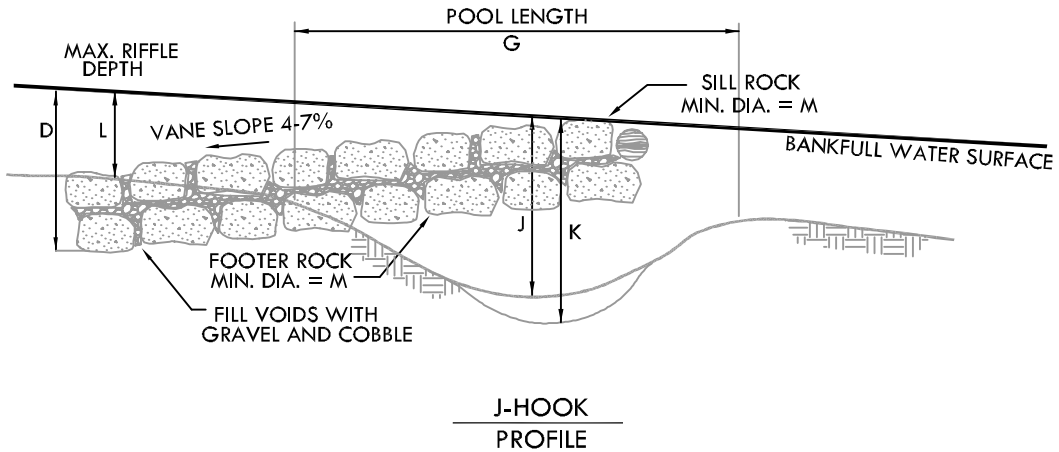
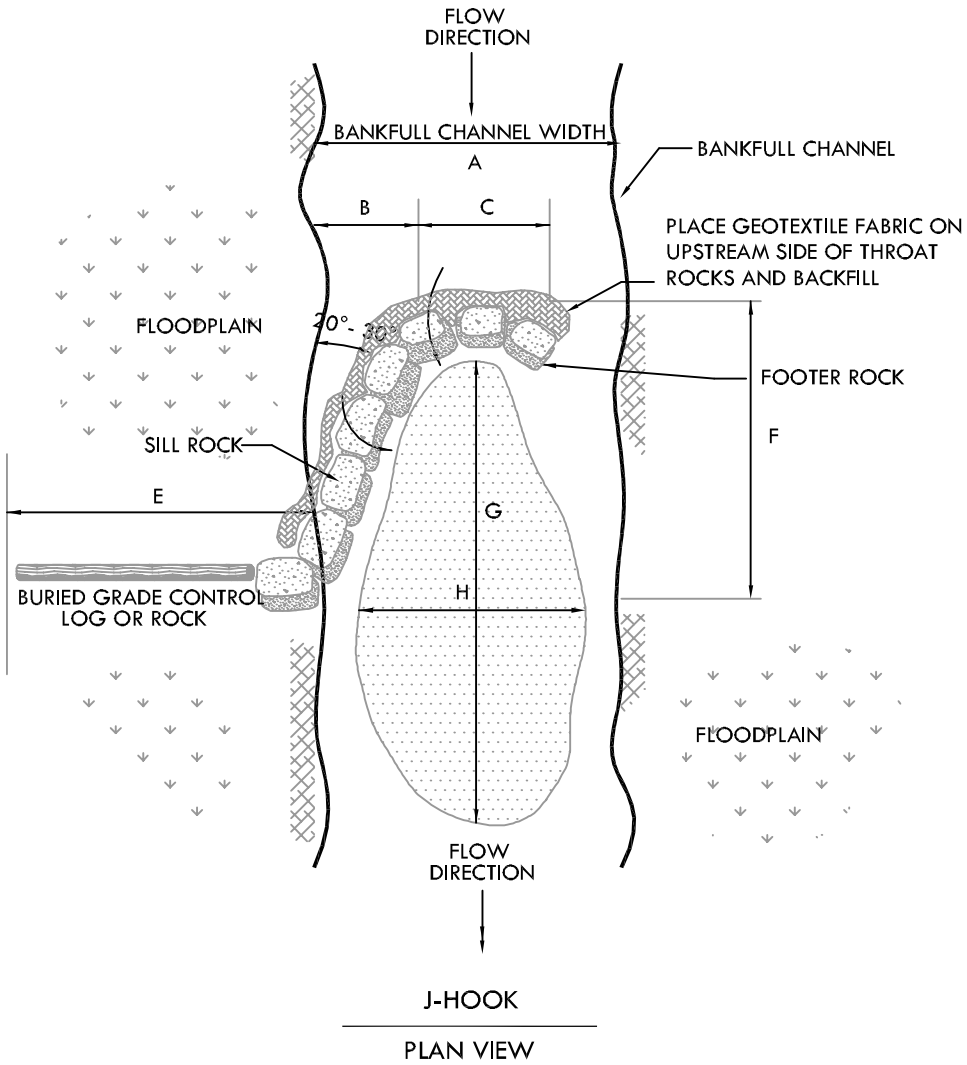
CONSTRUCTION NOTES:


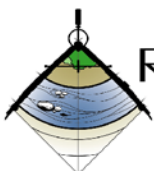
- 1. Construction shall begin at structure throat (upstream center) and proceed downstream toward banks. Use footer and sill rocks with minimum size as specified. Vane arm slope shall be between 4% and 7% as specified by the Construction Manager.
- 2. Excavate trench and stockpile excavated material for use as backfill. Place base of footer rocks at or below maximum scour depth. Minimize gaps between footer rocks. The Construction Manager shall inspect all footers prior to backfilling. Backfill sides of footer rocks with native gravel and cobble. Backfill shall be obtained from stockpiled material or excavated from downstream pool.
- 3. Place geotextile on upstream side of footer rocks. Place sill rocks on top of geotextile and footer rocks. Sill rocks should be placed slightly upstream of footer rocks. Gaps may be left between throat sill rocks. The Construction Manager shall inspect the placement and elevation of geotextile and sill rocks. The top of sill rocks shall not exceed the bankfull elevation. Backfill the geotextile and upstream side of sill rocks.
- 4. Backfill voids around structure with native gravel and cobble to fill gaps and reduce piping of water. Backfill shall be obtained from stockpiled material or excavated from downstream pool.
- 5. Floodplain grade control sills shall be constructed of log or rock and shall be keyed into the floodplain no less than 50% of the maximum riffle depth. Top of floodplain grade control sills shall be 0.5 feet below bankfull elevation and covered with 0.5 feet of sod/shrub transplants.
- 6. Excavate pool according to specified dimensions. Use excavated material to backfill structure or haul to a location approved by the Construction Manager.
- 7. Notify the Construction Manager of any proposed changes prior to implementation. The Construction Manager reserves the right to modify structure design specifications during construction, if warranted, due to unforeseen conditions.

STRUCTURE DIMENSIONS			
A = BANKFULL WIDTH			
B = ARM WIDTH		0.33 A	
C = THROAT WIDTH		0.33 A	
D = MAXIMUM RUN SCOUR DEPTH			
E = FLOODPLAIN GRADE CONTROL WIDTH			
F = LINEAR VANE LENGTH		A	
G = POOL LENGTH		A	
H = POOL WIDTH			
J = MAXIMUM POOL DEPTH			
K = MAXIMUM POOL SCOUR DEPTH			
L = MEAN RUN DEPTH			
M = MINIMUM ROCK DIAMETER		6 FT	



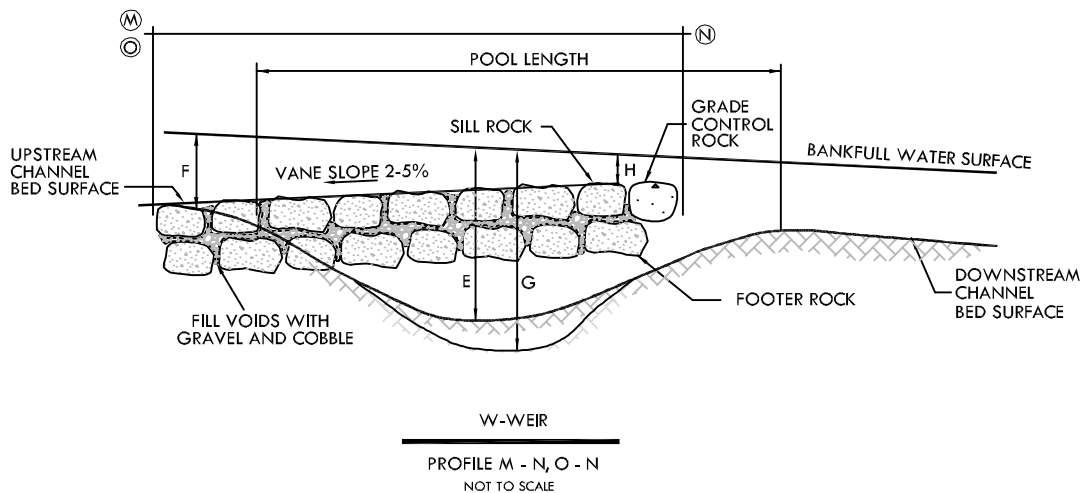
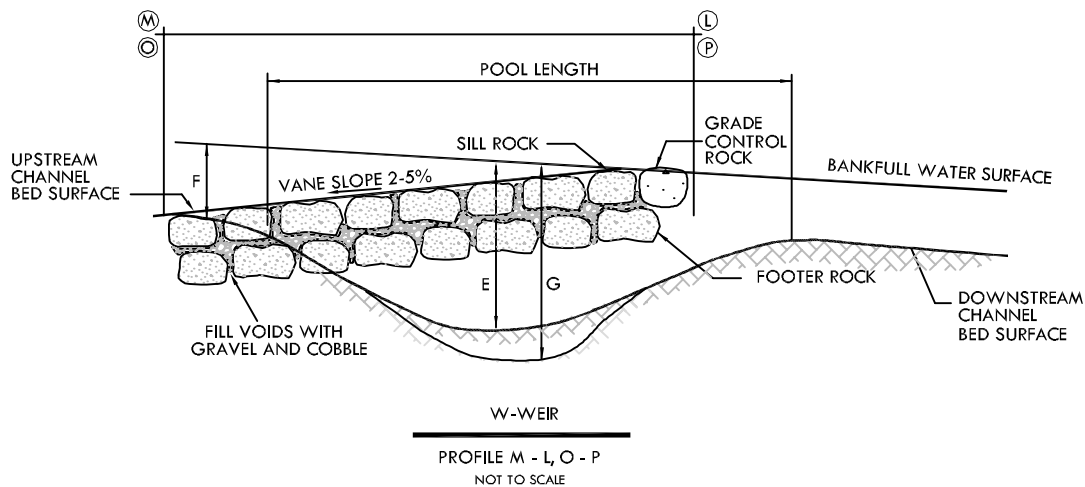
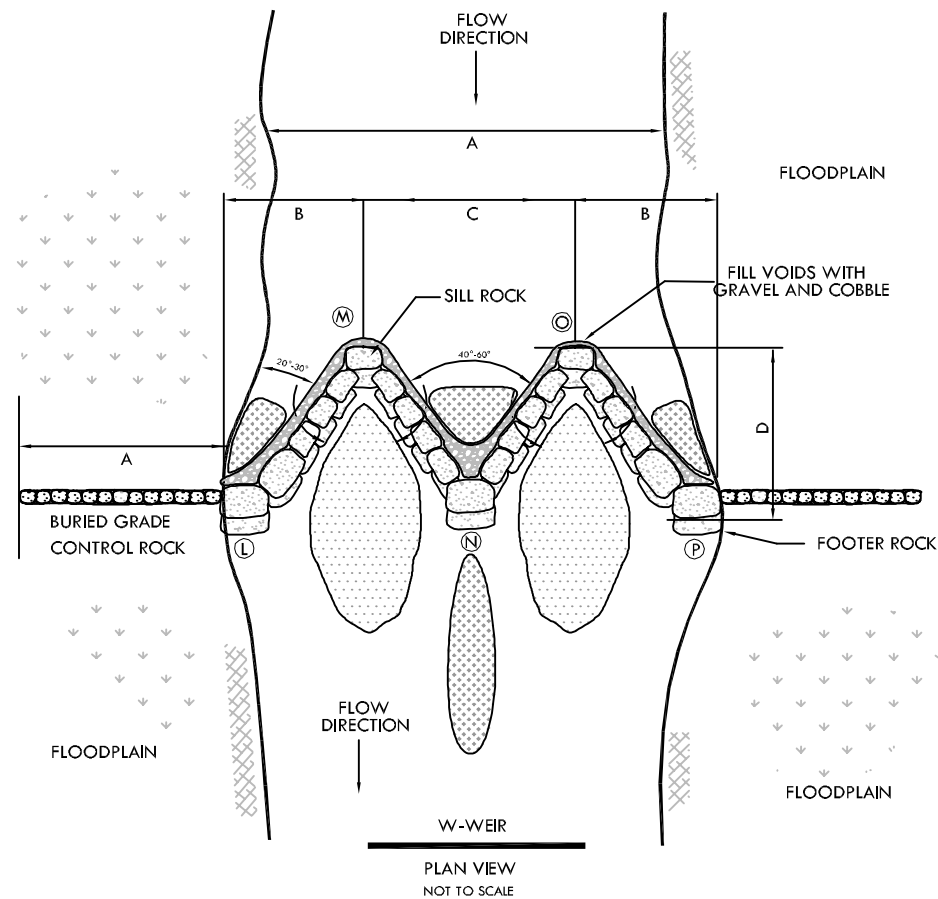
EXAMPLE OF A CONSTRUCTED ROCK J-HOOK VANE



					ROCK J-HOOK VANE			WestWater Consultants, Inc. 1112 Catherine Lane Corvallis, MT 59828 tel: (406) 961-3348	 <u>WestWater Consultants, Inc.</u>	
					RESTORATION PLAN					
					DRAWN BY:	NMW	SHEET L-3	NOT TO SCALE	River Design Group, Inc. P.O. Box 1722 Whitefish, MT 59937 tel: (406) 862-4927 fax: (406) 862-4963 www.riverdesigngroup.net	 RIVER DESIGN GROUP, INC.
	2	10-14-05	MSD	FINAL	DESIGNED BY:	GTD/MSD				
	1	04-13-05	NMW	DRAFT	CHECKED BY:	MSD	FILE NAME:			
	NO.	DATE	BY	REVISION DESCRIPTION	PROJECT NO.:	RDG-04-018	rock j-hook.dwg			

CONSTRUCTION NOTES:

1. Construction shall begin at structure throat (upstream center) and proceed downstream toward banks. Use footer and sill rocks with minimum size as specified. Vane arm slope shall be between 2% and 5% as specified by the Construction Manager.
2. Excavate trench and stockpile excavated material for use as backfill. Place base of footer rocks at or below maximum scour depth. Minimize gaps between footer rocks. The Construction Manager shall inspect all footers prior to backfilling. Backfill sides of footer rocks with native gravel and cobble. Backfill shall be obtained from stockpiled material or excavated from downstream pool.
3. Place sill rocks on top of footer rocks. Sill rocks should be placed slightly upstream of footer rocks. Minimize gaps between sill rocks. The Construction Manager shall inspect the placement and elevation of sill rocks. The top of sill rocks shall not exceed the bankfull elevation.
4. Backfill voids around structure with native gravel and cobble to fill gaps and reduce piping of water. Backfill shall be obtained from stockpiled material or excavated from downstream pool.
5. Floodplain grade control sills shall be constructed of rock and shall be keyed into the floodplain no less than 50% of the maximum riffle depth. Top of floodplain grade control sills shall be 0.5 feet below bankfull elevation and covered with 0.5 feet of sod/shrub transplants.
6. Excavate pool according to specified dimensions. Use excavated material to backfill structure or haul to a location approved by the Construction Manager.
7. Notify the Construction Manager of any proposed changes prior to implementation. The Construction Manager reserves the right to modify structure design specifications during construction, if warranted, due to unforeseen conditions.



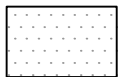
STRUCTURE DIMENSIONS

A = BANKFULL WIDTH	
B = VANE ARM WIDTH	0.25 A
C = VANE ARM WIDTH	0.5 A
D = STRUCTURE WIDTH	A
E = POOL DEPTH	
F = THROAT DEPTH/MAX. RIFFLE DEPTH	
G = POOL SCOUR DEPTH	
H = WEIR DEPTH	0.5 F
J = MINIMUM SILL ROCK DIAMETER	6 ft



EXAMPLE OF A CONSTRUCTED W-WEIR

LEGEND



SCOUR POOL



DEPOSITION MATERIAL

W-WEIR GRADE CONTROL STRUCTURE

RESTORATION PLAN

DRAWN BY: NMW
DESIGNED BY: MSD
CHECKED BY: MSD
PROJECT NO.: RDG-04-018

**SHEET
L-4**

FILE NAME:
L-4 W-Weir.dwg

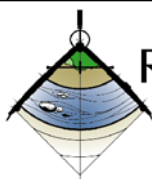
NOT TO
SCALE

WestWater Consultants, Inc.
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tel: (406) 961-3348



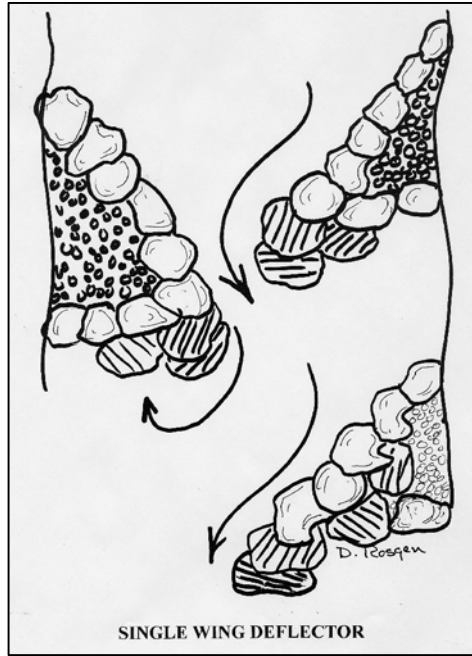
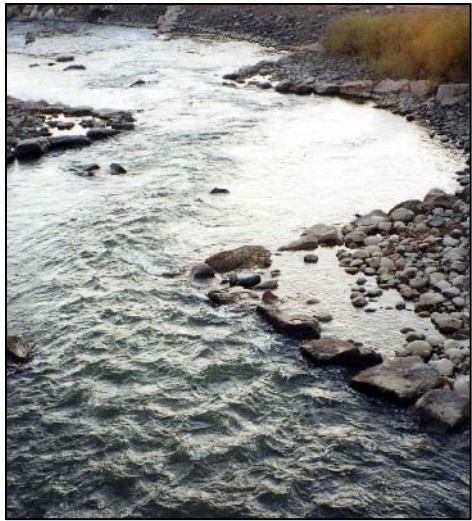
WestWater Consultants, Inc.

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Whitefish, MT 59937
tel: (406) 862-4927
fax: (406) 862-4963
www.riverdesigngroup.net

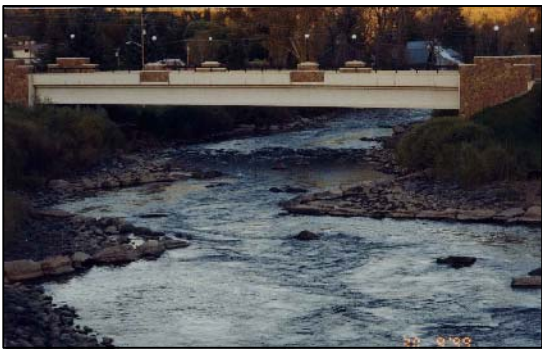
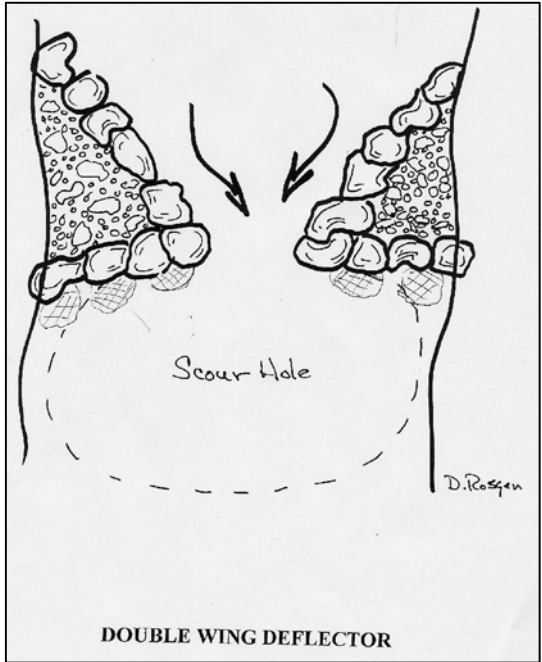


**RIVER
DESIGN
GROUP, INC.**

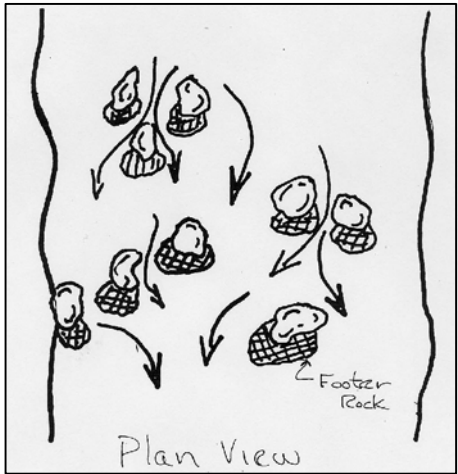
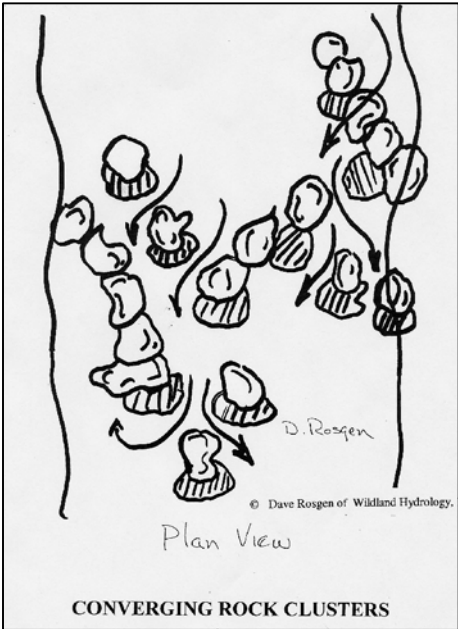
Single Wing Deflector



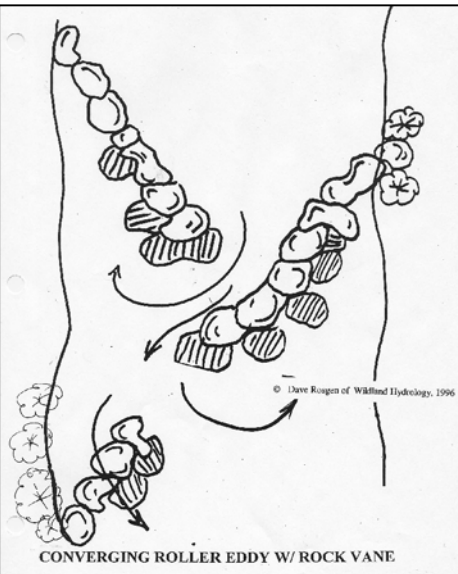
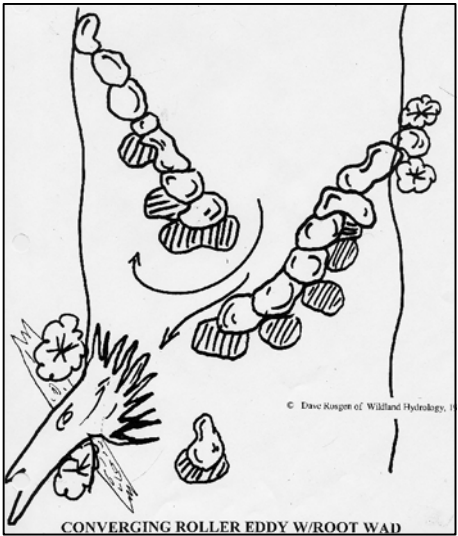
Double Wing Deflector



Converging Rock Clusters



Converging Roller Eddy w/ Root Wad



Seal

Structures designed by D. Rosgen
of Wildland Hydrology Inc.

2	10-14-05	KLC	FINAL
1	04-13-05	MSD	DRAFT
NO.	DATE	BY	REVISION DESCRIPTION

RIFFLE HABITAT STRUCTURES

RESTORATION PLAN

DRAWN BY:	NMW	SHEET L-5	NOT TO SCALE
DESIGNED BY:	DR		
CHECKED BY:	MSD	FILE NAME:	
PROJECT NO.:	RDG-04-018	L-5 Riffle Habitat	

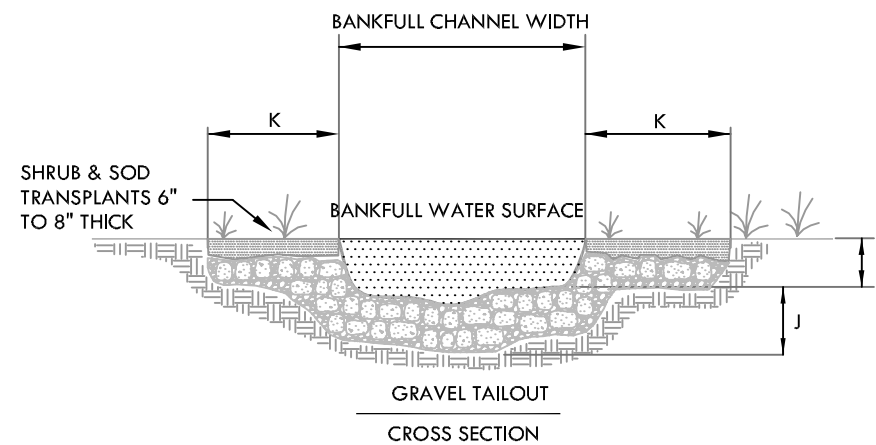
WestWater Consultants, Inc.
1112 Catherine Lane
Corvallis, Montana 59828
tel: (406) 961-3348




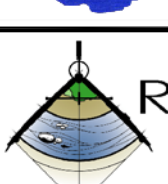
River Design Group, Inc.
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Whitefish, MT 59937
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www.riverdesigngroup.net

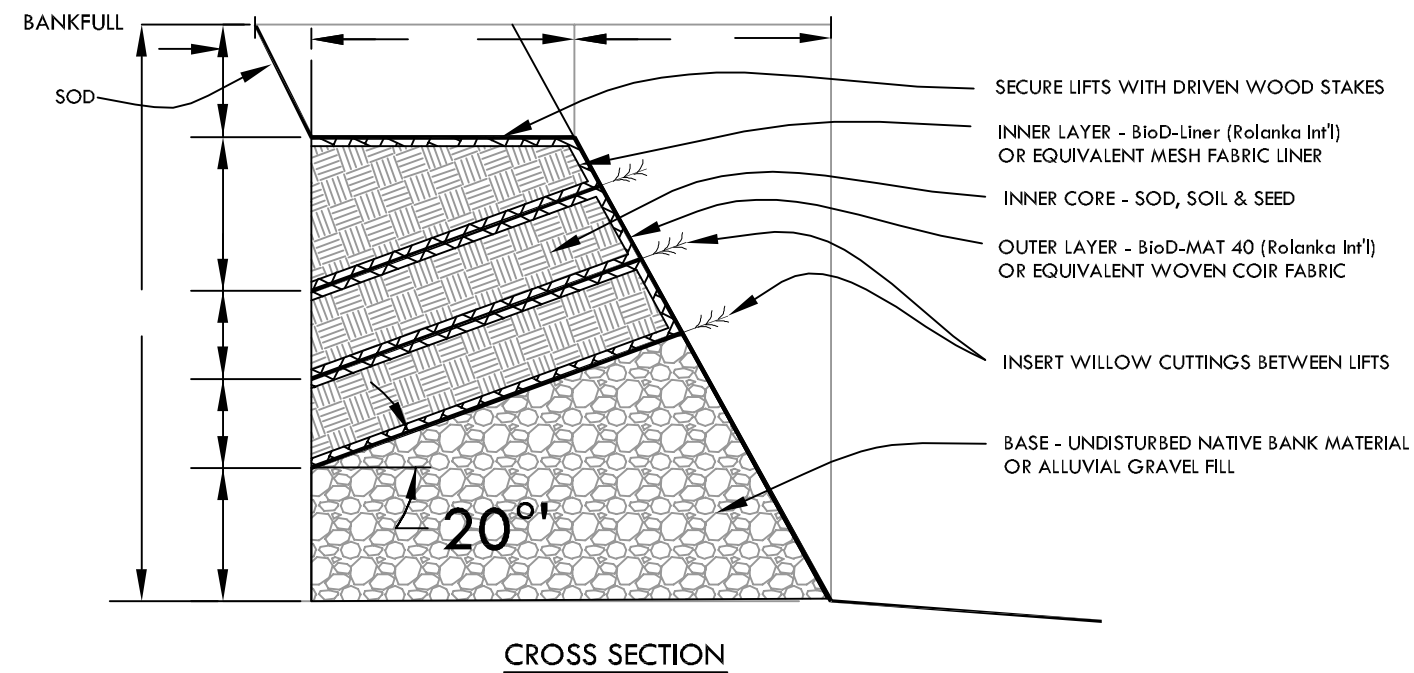



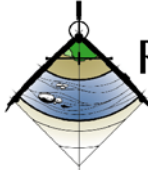
1. Excavate trench to specified structure dimensions and stockpile excavated material for use as backfill. Use rounded material with D50 as specified.
2. Shape the channel to the specified feature dimensions upstream and downstream of structure.
3. The Construction Manager shall inspect the orientation and elevation of the structure prior to backfilling.
4. The top of floodplain grade control sill shall be 0.5 feet below bankfull elevation and covered with 0.5 feet of sod/shrub transplants.
5. Notify the Construction Manager of any proposed changes prior to implementation. The Construction Manager reserves the right to modify structure design specifications during construction, if warranted, due to unforeseen conditions.



STRUCTURE DIMENSIONS	
A = UPSTREAM WIDTH	
B = POOL WIDTH	
C = RIFFLE WIDTH	
D = DOWNSTREAM WIDTH	
E = STRUCTURE LENGTH	
F - UPSTREAM DEPTH	
G = MAX. RIFFLE DEPTH	
H = MAX. RIFFLE DEPTH	
J - STRUCTURE DEPTH	
K = BANK KEY-IN WIDTH	
L = GRAVEL D50	

					COBBLE TAILOUT			WestWater Consultants, Inc. 1112 Catherine Lane Corvallis, Montana 59828 tel: (406) 961-3348	 WestWater Consultants, Inc.
					RESTORATION PLAN				
					DRAWN BY:	NMW	SHEET L-6	River Design Group, Inc. P.O. Box 1722 Whitefish, MT 59937 tel: (406) 862-4927 fax: (406) 862-4963 www.riverdesigngroup.net	 RIVER DESIGN GROUP, INC.
	2	10-14-05	KLC	FINAL	DESIGNED BY:	GTD/MSD			
	1	04-03-05	MSD	DESIGN	CHECKED BY:	GTD/MSD	FILE NAME:		
	NO.	DATE	BY	REVISION DESCRIPTION	PROJECT NO.:	RDG-04-006	L-6 Cobble Patch		



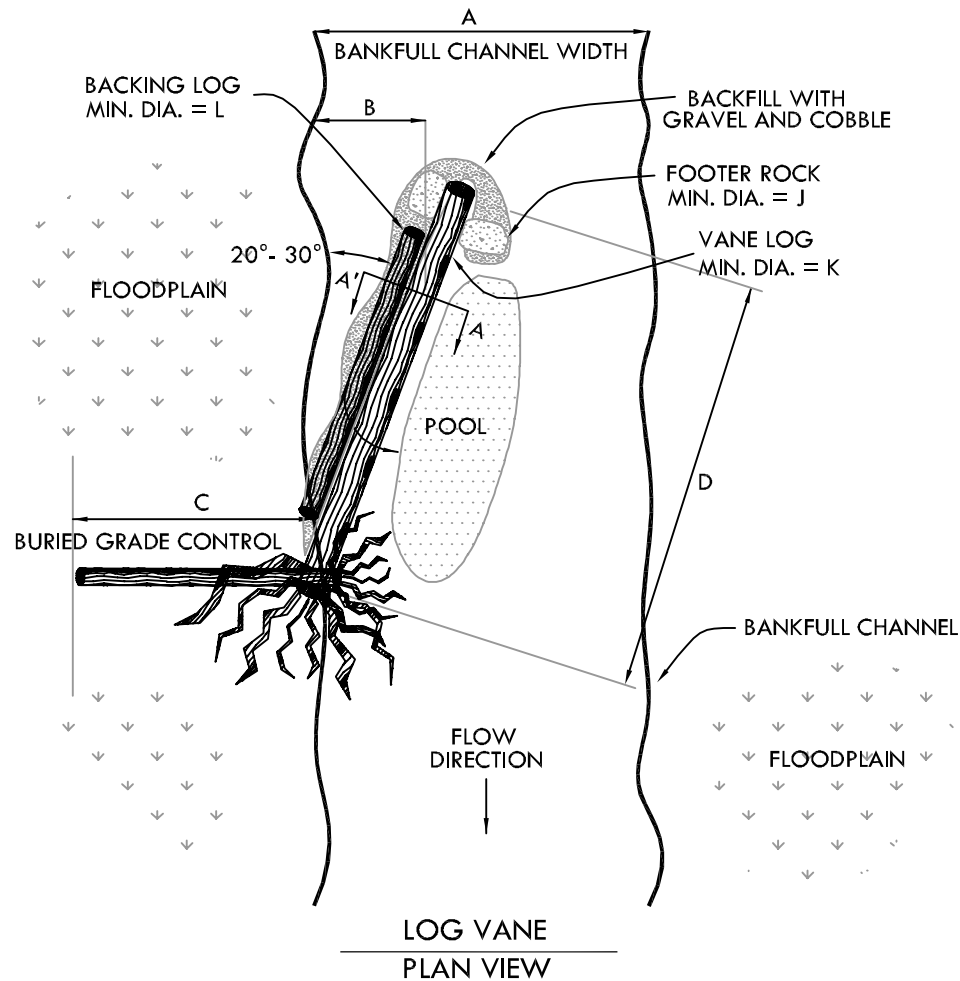
				BIOENGINEERED SOIL LIFT			WestWater Consultants, Inc. 1112 Catherine Lane Corvallis, Montana 59828 tel: (406) 961-3348	 WestWater Consultants, Inc.	
				RESTORATION PLAN					
				DRAWN BY:	NMW	SHEET L-7	NOT TO SCALE	River Design Group, Inc. P.O. Box 1722 Whitefish, MT 59937 tel: (406) 862-4927 fax: (406) 862-4963 www.riverdesigngroup.net	 RIVER DESIGN GROUP, INC.
2	10-14-05	KLC	FINAL	DESIGNED BY:	GTD/MSD				
1	04-03-05	MSD	DRAFT	CHECKED BY:	GTD/MSD	FILE NAME: L-7 BIOENGINEERED SOIL LIFT			
NO.	DATE	BY	REVISION DESCRIPTION	PROJECT NO.:	RDG-04-018				

CONSTRUCTION NOTES:

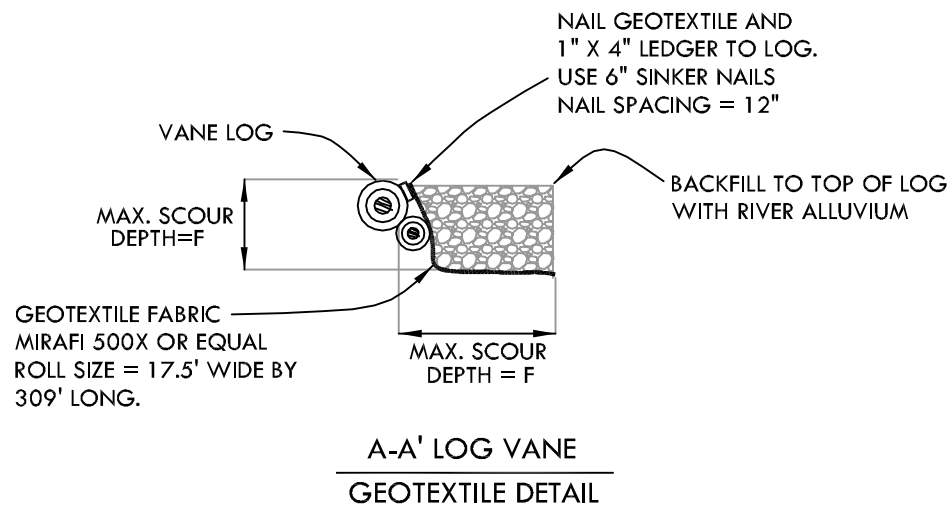
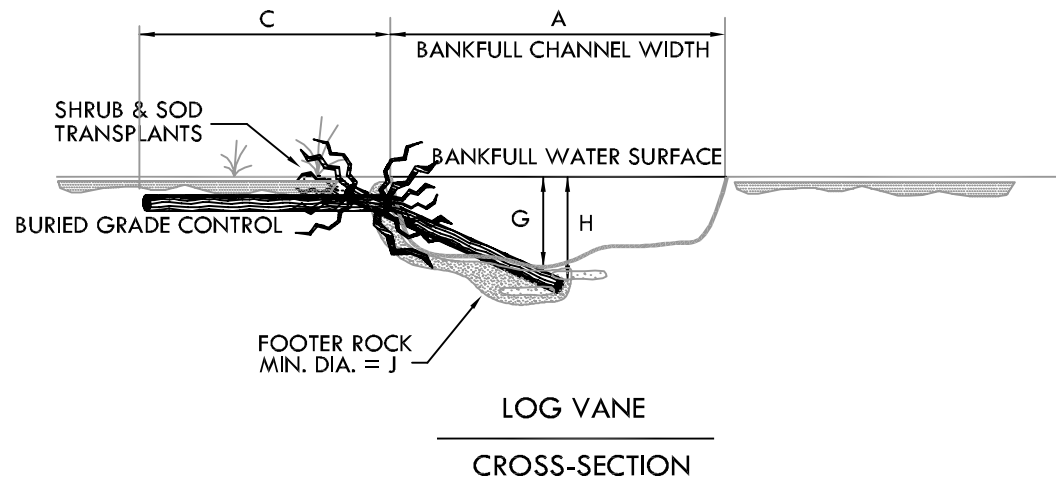
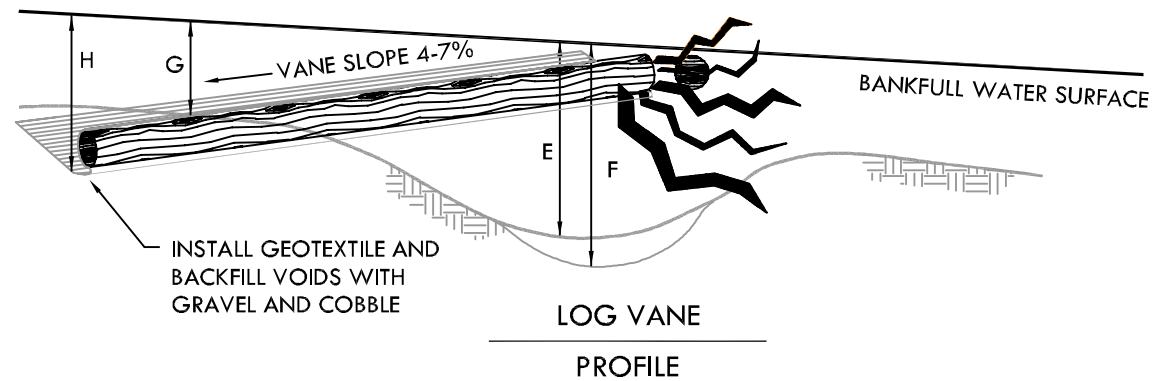
1. Use vane and backer logs with minimum dimensions as specified. Vane arm slope shall be between 4% and 7% as specified by the Construction Manager.
2. Excavate trench and stockpile excavated material for use as backfill. Place base of upstream end of log below maximum run scour depth. Anchor the upstream end of the vane log with footer rocks as specified. Place backing log behind/upstream of vane log.
3. Attach geotextile fabric and ledger to upstream side of vane log just below top of log so that fabric will not be exposed after backfilling. Nails shall be minimum 6-inch length sinker nails. Nail spacing shall be no more than 12 inches.
4. The Construction Manager shall inspect the orientation and elevation of the structure prior to backfilling. Backfill upstream side of vane log with native gravel and cobble. Backfill shall be obtained from stockpiled material or excavated from downstream pool.
5. A floodplain grade control sill shall be constructed of log or rock and shall be keyed into the floodplain no less than 50% of the maximum riffle depth. The vane log shall be placed on top of the sill log. Rootfans of the sill log and vane logs shall be placed at the edge of the bankfull channel. The top of floodplain grade control sill shall be 0.5 feet below bankfull elevation and covered with 0.5 feet of sod/shrub transplants.
6. Excavate pool according to typical pool dimensions. Use excavated material to backfill structure, or haul to a location approved by the Construction Manager.
7. Notify the Construction Manager of any proposed changes prior to implementation. The Construction Manager reserves the right to modify structure design specifications during construction, if warranted, due to unforeseen conditions.

STRUCTURE DIMENSIONS

A = BANKFULL WIDTH	
B = VANE ARM WIDTH	.33 A
C = FLOODPLAIN SILL WIDTH	.33 A
D = LINEAR VANE ARM LENGTH	60 ft
E = MAX. POOL DEPTH	
F = MAX. POOL SCOUR DEPTH	
G = THROAT DEPTH	
H = MAX. RUN SCOUR DEPTH	
J = MIN. ROCK DIAMETER	5.0 ft
K = MIN. VANE LOG DIA.	24 in
L = MIN. BACKING LOG DIA.	18 in



EXAMPLE OF A CONSTRUCTED LOG VANE



FOR CFR3 ONLY

NO.	DATE	BY	REVISION DESCRIPTION
2	10-14-05	KLC	FINAL
1	04-13-05	MSD	DRAFT

LOG VANE

RESTORATION PLAN

DRAWN BY:	MSD	SHEET L-8
DESIGNED BY:	GTD/MSD	
CHECKED BY:	GTD/MSD	FILE NAME:
PROJECT NO.:	RDG-04-018	L-9 Log Vane

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DESIGN
GROUP, INC.